

Report on the January 1999 Detroit Snowstorm

**Submitted to the Honorable John D. Dingell
United States House of Representatives**

by

The Secretary of the Department of Transportation

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INTRODUCTION

In a January 5, 1999, letter, Member of Congress John D. Dingell requested the Secretary of Transportation to review the response of Northwest Airlines and the Wayne County Department of Airports to the January 2-3, 1999, snowstorm at Wayne County Detroit Metropolitan Airport, Northwest Airlines' largest hub airport. Other Members of Congress made similar requests. Pursuant to these requests, and prompted by dozens of passenger complaints concerning extended ground delays on Northwest Airlines aircraft that weekend, which were lodged with the Department of Transportation's Aviation Consumer Protection Division, the Secretary assembled a team of individuals from the Department to prepare this Report.

This Report examines what occurred at the airport on Saturday, January 2 and Sunday, January 3, why it occurred, and what measures Northwest Airlines and the Wayne County Department of Airports are taking to try to prevent the repetition of the serious customer service problems that arose that weekend, in particular, the stranding of hundreds of passengers on aircraft queued on taxiways for up to 8 hours. The review team's numerous findings regarding the causes of these ground delays can be summarized as follows:

- Saturday's ground delays were largely a result of the decision by Northwest's operations planners in Minneapolis, who were responsible for dispatching aircraft to and from Detroit, to continue limited operations at Detroit well after other airlines had cancelled their flights for the day because of the snowstorm. As the storm worsened, flight departures were increasingly delayed because of rapid snow accumulation, drifting snow, and de-icing difficulties. When Northwest finally shut down its Detroit operations, a dozen of its aircraft were still waiting to take off and, at the height of the storm, were forced to make their way back to a terminal with limited gate availability.
- On Sunday, a lack of clear and coordinated communications between Northwest's operations planners in Minneapolis and Northwest's management in Detroit prevented the operations planners from realizing that Northwest's Detroit terminal could not accommodate even the limited number of arrivals scheduled for Sunday until it was too late to cancel or divert many of those arrivals. Northwest would likely have avoided or mitigated any backlog of aircraft waiting for gates had key Minneapolis and Detroit personnel reviewed major storm response issues in regularly scheduled conference calls on Saturday and Sunday.
- While Northwest's Detroit employees worked very hard in attempting to prepare the airport for Sunday operations, they were so preoccupied with "putting out fires" that they failed to recognize and communicate the overall severity and implications of the problems they faced throughout the day. Had Northwest had a snow emergency plan for Detroit that designated a person to oversee and assess the airline's response to such severe snowstorms and communicate its progress to Minneapolis operations planners, then the planners would have received a more accurate assessment of that

progress and would likely have implemented a more conservative Sunday arrival schedule.

- Both Northwest and the Wayne County Department of Airports could have improved snow removal and aircraft positioning efforts, and thus helped mitigate ground delays, through formal communications channels set up as part of a coordinated snow emergency plan and through a clearer understanding of their respective snow removal obligations.
- Northwest failed to anticipate the severity of the flight crew shortage at Detroit on Sunday. The shortage was caused by a number of factors, including difficulties in getting to the airport terminal and the overloading of the airline's various automated crew communication and scheduling systems. Without sufficient crews, Northwest could not launch enough aircraft from Detroit to free sufficient gates to deplane passengers on incoming flights in a timely manner.
- Northwest's efforts to deplane stranded passengers were hindered by the lack of a contingency plan for the storm's effects on gates and taxiways. Attempts to secure unused gates of other airlines were not well coordinated: although one airline, Continental, provided an unused gate for Northwest's use, other airlines indicated that Northwest either did not ask them for use of their gates or, when it did ask, that their gates were occupied or about to be occupied. The lack of such a plan also contributed to Northwest's inability to deplane passengers with mobile or integrated aircraft stairs or to provide stranded aircraft with remote lavatory and catering services.

Northwest and the Wayne County Department of Airports have taken or are considering taking several remedial actions to try to prevent a repetition of the lengthy ground delays of January 2 and 3, 1999. These actions include the following:

- Preparation of an Irregular Operations Plan for Northwest's operations at Detroit.
- Revision of Northwest's operations planners' Winter Response Manual.
- Posting of a Wayne County Department of Airports operations specialist in the Northwest tower during snow removal operations.
- Implementation of various snow removal improvements by Northwest and the Wayne County Department of Airports.
- Drafting of arrival delay guidelines for Northwest flights.
- Designation by Northwest and the Wayne County Department of Airports of aircraft parking areas in the event of a snowstorm.
- Implementation of a number of improvements to Northwest's crew coordination and scheduling systems.

- Consideration by Northwest of procedures that would allow remote stair deplaning in certain circumstances.
- Greater awareness by Northwest management of the need to bring resources to bear in irregular situations such as snowstorms and the realization that Northwest's "keep things moving" mission focus at times must be reevaluated.
- A letter of apology and a voucher for a free round trip ticket from Northwest for each passenger who experienced a ground delay of at least 2_ hours while in Detroit on January 2-4.

The Federal Aviation Administration has determined that neither the airport nor any air carrier serving Detroit violated Federal Aviation Regulations in their handling of the January 2-3 Detroit snowstorm. It is also important to note that even some of the angriest complaint letters received by the Department from passengers who experienced ground delays complimented the fine performance of Northwest's flight crews. However, notwithstanding the often exceptional efforts of those crews, conditions on many of the aircraft stranded on the airport's taxiways were severe enough to have jeopardized passengers' well being. These conditions included a shortage or complete lack of food, beverages, and water, and non-functioning lavatories. Conditions were particularly difficult for persons travelling with infants in need of formula or for persons with certain medical conditions. At least two individuals required emergency treatment by paramedics brought to the aircraft, and others were assisted by doctors already on board the aircraft. While these cases represented only a small percentage of the total number of passengers stranded by ground delays, they were serious and indicate that this event had important implications for passenger safety. Moreover, even if the well being of passengers had not been an issue, the review team believes that the stranding of passengers on aircraft queued on taxiways for up to 8_ hours invites more serious problems and is simply unacceptable. None of the other airlines serving Detroit experienced ground delays approaching the magnitude of Northwest's delays.

In understanding the events detailed in this Report, it is important to recognize the various roles and responsibilities that the Department of Transportation, the air carriers, and the airport have in handling major weather events like the January 2-3 Detroit snowstorm. The airport is responsible for the operating condition of the airport, including snow removal, and determines when a runway or taxiway must be closed. The Federal Aviation Administration, through its Air Traffic Control System, is responsible for the safe and efficient management of air traffic while aircraft are en route. While air carriers must always adhere to the Federal Aviation Regulations that are promulgated by the Federal Aviation Administration, as well as the rules of the particular airports, individual airlines are responsible for managing disruptions to their schedules at particular airports. The airlines decide what flights to operate and have exclusive responsibility for canceling specific flights.

The review team interviewed over 60 individuals in preparing this report, including passengers, Northwest Airlines managers and executives in Detroit and in Minneapolis, Wayne County Department of Airports managers and executives, and representatives of other airlines serving the Wayne County Detroit Metropolitan Airport. The review team also relied on Northwest Airlines' and the Wayne County Department of Airports' documents concerning the snowstorm. The review team benefited greatly from the work performed by the staff of the Federal Aviation Administration's Great Lakes Regional Office in Chicago and the Minneapolis Flight Standards Certificate Management Office, both for their direct support of this report and for their input on relevant issues. The Department sincerely appreciates the time that all these individuals took to meet with the review team and discuss the snowstorm.

This report is divided into three Parts. Part I briefly describes the Wayne County Detroit Metropolitan Airport and Northwest Airlines' operations there, Northwest Airlines' operations planning organization at its Minneapolis headquarters, and then describes chronologically the January 2 Detroit snowstorm and its impact on the airport and on Northwest Airlines' operations. Part II sets forth the review team's findings concerning why the events at the Wayne County Detroit Metropolitan Airport unfolded the way they did. These findings are grouped into six subject-matter areas: (1) Northwest's arrival and departure planning; (2) Northwest's assessment of its preparations for Sunday's operations; (3) Wayne County Detroit Metropolitan Airport's and Northwest Airlines' snow removal operations; (4) aircraft positioning; (5) Sunday ground and flight crew staffing levels; and (6) Northwest's treatment of passengers stranded on its aircraft. Part III reviews the actions that Northwest Airlines and Wayne County Department of Airports have taken or are considering taking to prevent a repetition of the lengthy ground delays of January 2 and 3.

PART I: THE JANUARY 2 DETROIT SNOWSTORM AND ITS AFTERMATH

Part I of the report will briefly describe the Wayne County Detroit Metropolitan Airport ("DTW") and Northwest Airlines' ("NWA") operations there, and NWA's operations planning organization at NWA's Minneapolis headquarters. Part I then describes chronologically the January 2-3 Detroit snowstorm and its impact on the airport and NWA's operations.

Wayne County Detroit Metropolitan Airport and NWA

DTW is operated by the Wayne County Department of Airports ("WCDA") and is the largest of NWA's three major air travel hubs. NWA's flight operations at DTW are typical of any major airline's at one of its hub airports. Several times each day, large numbers, or "banks," of NWA aircraft flying domestic and international routes arrive within a short period of time and deplane their passengers, many of whom board NWA connecting flights for their ultimate destinations. After one bank of aircraft has arrived and departed, the next bank soon follows. These banks of aircraft have use of 60 NWA gates at DTW, although not all of these gates can accommodate all seven aircraft types flown by NWA. (NWA operates all seven types through DTW.) Most major U.S. airlines serve DTW, as do a number of smaller U.S. carriers, commuter airlines, foreign carriers, and charter airlines. In 1998, NWA's flights accounted for approximately 57% of DTW's total scheduled passenger operations.

An aspect of DTW that is important to a discussion of the impact of the snowstorm is its gate configuration. As illustrated by the map and photographs of DTW's terminals set forth in Appendices A-C, DTW's domestic gates are grouped in seven piers that extend out from the main terminal buildings. The areas between the piers housing NWA's gates (Piers C - G), known as "alleys," are among the narrowest at any U.S. airport. Even in good weather conditions, aircraft congestion in these alleys can cause arrival and departure delays for NWA. These narrow alleys are particularly ill suited for operations during and after a snowstorm.

NWA's Operations Planning

NWA's daily operations are planned and controlled by the groups that comprise Systems Operations Control ("SOC"). An SOC Director ensures that the SOC groups act as a coordinated team. Departments within the SOC include the following:

- Crew Coordinators - This department is responsible for rescheduling pilots and flight attendants that are currently flying.
- Crew Scheduling - This department maintains the assignment of crew members to depart on their initial flight segment.
- Flight Dispatch - This department authorizes, regulates, and monitors flights according to FAA and company regulations to ensure operational safety for each flight.

- **Maintenance Control** - This department is the central coordination center for maintenance activities.
- **Meteorology** - This department provides weather forecasts and worldwide weather data.

During a snowstorm, the SOC Operations Planners receive data from each of these departments and from the airports served by NWA, and are responsible for monitoring and coordinating NWA's response to schedule problems and any other potential problems.

Friday, January 1

A description of the January 2 snowstorm, its impact on the airport and NWA's operations, and NWA's response to it must begin with NWA's planning for the storm on January 1. At noon on that day, NWA's meteorologists predicted that light snow would begin falling at DTW on Saturday morning, with accumulations of one to three inches possible. Accumulations of 8 to 10 inches were predicted by midnight, followed by additional precipitation in the form of snow and sleet from 4:00 a.m. to 8:00 a.m. Sunday, changing to freezing rain or rain after that. This weather forecast prompted a decision at a 2:00 p.m. conference call to reduce the number of arrival/departure combinations at DTW on Saturday afternoon by 50 flights. NWA's meteorologists issued a less severe weather forecast for DTW on Friday night, but NWA did not change its flight-thinning plan.

Saturday, January 2

The snowfall at DTW on Saturday morning was much as NWA's meteorologists had originally predicted, and NWA experienced no major operational problems that morning. At 12:15 p.m., NWA's meteorologists predicted a snowfall rate that afternoon of up to two inches per hour. Every other airline had already cancelled their afternoon and evening flights in and out of DTW. In many cases they had done so the day before. NWA, however, did not cancel its flights.

At 1:00 p.m. on Saturday, the NWA SOC Director, located at NWA headquarters in Minneapolis, was asked by the NWA Control Center Manager at DTW to further trim afternoon arrivals in light of deteriorating weather conditions in Detroit. One half hour later, NWA's Chief Dispatcher, also located at NWA headquarters in Minneapolis, suggested that, while the deteriorating weather conditions were still above legal minimums for NWA's aircraft operations, the conditions were bad enough to justify a shutdown of NWA's operations. In addition to moderate snowfall, winds had increased to 16 knots, gusting to 27 knots. Given that conditions were still above legal minimums, however, the SOC Director decided that NWA's operations at Detroit should continue, although he did reduce the number of arrivals from 39 to 25 per bank.

By 2:00 p.m. on Saturday, the snowfall and the winds had intensified. By 2:30 p.m., approximately 5 inches of snow covered the areas around NWA's gates. At 3:30 p.m., the NWA Control Center Manager at DTW advised the SOC Director that more arrival

thinning was required because they only had sufficient gate availability for 13 more flights. When the SOC Director determined that this count included aircraft still queued for departure at the remote de-icing pad, he ordered a "ground stop" that halted all remaining flights bound for DTW that were still on the ground. In addition, he began diverting flights that were already on their way. The last NWA arrival of the day landed at 4:46 p.m., nearly five hours after all other airlines had cancelled their DTW flights.

Between 4:00 p.m. and 7:00 p.m. on Saturday, there were six to twelve inch drifts of dry blowing snow in the alleys between terminal piers and up to twelve-inch drifts of dry blowing snow on the open runways. Snowfall was intensifying and visibility was poor. According to NWA, the aircraft de-icing pad was not plowed. However, according to WCDA officials, the 3-Center de-icing pad was cleared between 5:00 p.m. and 6:00 p.m. Shortly before 6:00 p.m., the ground stop halting all NWA flights bound for DTW was extended to 8:00 p.m., but NWA hoped that departures would continue, freeing gates currently in use. At 6:30 p.m., however, the NWA Control Center Manager at DTW asked the SOC Director to shut down NWA's DTW operations until at least noon on Sunday. At 7:00 p.m., a dozen NWA aircraft were still queued for pre-takeoff remote de-icing when de-icing crews working one of those aircraft found that ice was reforming before they could complete de-icing the aircraft. The de-icing crews gave up, and the 12 aircraft headed back to the terminal to deplane passengers as gates became available. All NWA flights to and from DTW were cancelled for the rest of the night. In addition, virtually all of Sunday morning's flights and approximately 90% of all Sunday's flights were ultimately cancelled. Dry blowing snow drifting up to two feet covered open taxiways. At the gates, frozen jet bridges started going out of service. Passengers on the last of the 12 aircraft that had been queued for de-icing and departure in the storm were not unloaded until early Sunday morning. Estimates of the number of people who were forced to sleep in the airport terminal overnight ranged between 1,000 and 3,500.

After passengers were deplaned, NWA had to move many of its aircraft to clear gates for additional aircraft. It moved 15 of those aircraft to the center of three of its terminal alleys because weather conditions made it unsafe to taxi or tow the aircraft to a hanger or other remote parking area. NWA would normally store its baggage carts overnight at empty gates, but because on Saturday night virtually every gate was occupied by aircraft, NWA moved many of its baggage carts to the alley between piers C and D.

Overall, on Saturday there were 444 total operations at DTW, of which 249 were arrivals and 195 were departures. As the storm increased in intensity, 28 NWA flights scheduled to depart from DTW experienced ground delays because of snow accumulation at the remote de-icing facility and the inability to de-ice. As noted above, some of these flights were ultimately cancelled and forced to return to the terminal, thus adding to NWA's ground delays. These NWA departure delays are summarized as follows:

NWA Departure Ground Delays Experienced on 1/2/99

Hours of Delay	No. of Flights	Estimated No. of Passengers
9+	3	240
8-9	4	320
7-8	2	160
6-7	0	0
5-6	1	80
4-5	1	80
3-4	5	400
2-3	1	80
1-2	4	320
<1	7	560
TOTAL:	28	2240

On Saturday, there were 116 NWA arrivals. The arrival delays for these NWA flights are summarized as follows:

NWA Arrival Ground Delays Experienced on 1/2/99

Hours of Delay	No. of Flights	Estimated No. of Passengers
4+	1	80
3-4	1	80
2-3	3	240
1-2	16	1280
<1	66	5280
On time	29	2320
TOTAL:	116	9280

Sunday, January 3

At 3:00 a.m. on Sunday, freezing rain began falling and was followed by another band of snow, which lasted until 6:00 a.m. Officially, 10.6 inches of snow had fallen at DTW since Saturday morning, but drifts were deeper. WCDA snow removal crews worked through the night plowing runways and taxiways. Alley entrances had been plowed, as had alleys used by other airlines serving DTW, but several NWA alleys could not be plowed because they were clogged with parked aircraft and baggage carts. (See Appendix D, Security Camera Photos of Alleys.) NWA Maintenance ("Maintenance"), which was nearly 100% staffed, committed to tow the aircraft from the alleys by 10:00 a.m. Despite a number of assurances that this could be done, at 8:55 a.m. Maintenance informed the NWA Control Center Manager that they would "do what we can" about moving the aircraft parked in the alleys. At 11:15 a.m., they reported that the aircraft

could not be moved because alleys needed plowing. (It should be noted that the SOC Director could not recall a conversation with NWA DTW personnel at 10:40 a.m. in which he was supposedly told to "shut it down, nothing's moving.")

At approximately noon on Sunday, when the first NWA departures from DTW were to have resumed, the SOC Director became concerned that no aircraft were leaving the gates. Over the next hour, he was first told by NWA's Detroit control center that the effort to launch departures "is going, but really slow" and then, twenty minutes later, told that the "aircraft aren't going anywhere." By 1:00 p.m., the SOC Director learned that ramps and alleys around the terminal piers were not plowed, that far fewer flight crews than had been estimated were available to operate departing flights, and that ground personnel staffing levels (other than Maintenance personnel) were at less than 50%. At 1:00 p.m., the SOC Director advised the Chief Dispatcher to cancel any departing flights that would arrive at DTW before 3:30 p.m., although flights that were already en route, including those that had already taxied away from their gates at their originating airports, could continue to DTW.

Between noon and 1:30 p.m. on Sunday, 11 NWA flights arrived at DTW. These flights waited on taxiways from two hours, 26 minutes to eight hours, 8 minutes for gates. (Two flights had arrived before noon and reached gates in 28 and 48 minutes respectively.) As of 1:30 p.m., no NWA flight had departed DTW. At 1:45 p.m., the SOC Director advised the Chief Dispatcher to hold all flights scheduled to depart for DTW until further notice because gates would not be available for at least another hour.

By 2:00 p.m. on Sunday, NWA's various automated crew communication and scheduling systems were becoming overloaded by the high volume of calls from delayed or stranded flight crew members, creating additional impediments to getting proper crews to flights waiting to depart DTW. Meanwhile, some arriving NWA aircraft were having difficulties negotiating taxiways. During the afternoon, a 747's engine hit three snow banks and a number of aircraft skidded on ice, in some cases blocking alleys until they could be towed. High winds continued throughout the day causing drifts and below-zero wind chills. Several jet bridges went out of service.

At 3:40 p.m. on Sunday, the SOC Director requested a national ground stop of flights scheduled to depart for DTW until at least 5:30 p.m. because of the continued shortage of gates. This ground stop was subsequently extended until 6:10 p.m., and again until 1:00 a.m. on Monday. Since 1:30 p.m., 23 more NWA flights had landed. Three more flights would arrive, all after 7:00 p.m. Of the 36 flights that had arrived by 3:40 p.m., 29 were still waiting on taxiways for gates. These waits lasted from one hour to eight hours, 38 minutes. The flight that experienced the latter delay was the last to deplane its passengers, at approximately 11:30 p.m.

Passengers reported that the conditions on the aircraft stranded for longer periods were dreadful. Few aircraft had any food on board and those that did had only peanuts and pretzels. Beverages, or at least water, were available on most, but not all, flights, and some eventually ran out. Some aircraft lavatory tanks filled up and, in some cases,

overflowed, leaving passengers without functioning lavatories for up to four hours and creating foul odors in the affected aircraft cabins. NWA was able to arrange remote lavatory servicing for three aircraft. Flight crews were generally polite throughout the ordeal and passed on what information they could to passengers, although this information was sometimes incomplete or incorrect. The latter reportedly included statements that FAA regulations precluded beverage service or remote deplaning, or that the FAA's air traffic control tower was denying planes access to gates. Conditions were particularly difficult for persons travelling with infants in need of formula or for persons with certain medical conditions. One person went into diabetic shock and another experienced cardiac arrest symptoms. The aircraft carrying these individuals were given emergency clearance to gates or gate areas, and these persons were assisted by paramedics. Other diabetics feared that they would go into shock. A number of individuals experienced anxiety attacks and were assisted by doctors on board or by other passengers.

At 7:15 p.m. on Sunday, NWA cancelled all flights to DTW for the rest of the evening with the exception of three DTW-bound flights that had been diverted to Minneapolis.

In summary, there were 398 total operations at DTW on Sunday, of which 223 were arrivals and 175 were departures. Of the arrivals, only 39 were NWA flights. The following chart summarizes the ground delays experienced by those NWA flights:

NWA Arrival Ground Delays Experienced on 1/3/99

Hours of Delay	No. of Flights	Estimated No. of Passengers
8+	4	320
7-8	5	400
6-7	4	320
5-6	3	240
4-5	2	160
3-4	8	640
2-3	4	320
1-2	5	400
<1	4	320
TOTAL:	39	3,120

These arrival delays are also summarized in a graph prepared by NWA and reproduced as Appendix E.

There were 122 NWA departure delays or cancellations after gate departure on Sunday.
They are summarized as follows:

NWA Departure Ground Delays Experienced on 1/3/99

Hours of Delay	No. of Flights	Estimated No. of Passengers
8+	4	320
7-8	0	0
6-7	6	480
5-6	3	240
4-5	6	480
3-4	9	720
2-3	11	880
1-2	17	1360
<1	66	5280
TOTAL:	122	9760

PART II: FINDINGS

The review team was generally familiar with the events chronicled above before it conducted its interviews in Detroit and Minneapolis. Although the team did gather additional factual details in the course of the interviews, its primary purpose in conducting the interviews was to determine why the events of that first weekend in January unfolded in the manner that they did and what NWA and WCDA are doing to prevent a repetition of those events. The team has analyzed the information it obtained from the interviews and from NWA and WCDA documents. Based on that analysis, the team makes the following findings regarding why the January 1 Detroit snowstorm resulted in lengthy tarmac delays on January 2 and 3 that left passengers stranded on aircraft for up to 8 hours. The findings are grouped into six subject-matter areas: (1) NWA's arrival and departure planning; (2) NWA's assessment of its preparations for Sunday's operations; (3) WCDA's and NWA's snow removal operations; (4) aircraft positioning; (5) Sunday ground and flight crew staffing levels; and (6) NWA's treatment of passengers stranded on its aircraft.

NWA's Arrival and Departure Planning

- **The decisions to reduce and then halt NWA operations on Saturday.** As a result of the SOC Director's decision to permit Saturday arrivals later than suggested by his Chief Dispatcher, a decision that the SOC Director believes was reasonable, additional aircraft would land at DTW, thus contributing to the gate congestion that evening and the following day. Also, additional aircraft would attempt to depart DTW that afternoon, increasing the number of passengers subject to lengthy tarmac delays into the early hours of Sunday.

Contributing to the SOC Director's decision to keep NWA's operations at DTW going after 1:30 p.m. on Saturday was his and NWA's strong commitment to doing everything possible to safely transport its passengers to their destinations on time and avoid stranding them overnight at airports. While his decision achieved that goal for Detroit-bound passengers who arrived Saturday afternoon, it contributed to delaying and stranding passengers aboard aircraft that night and the next day.

Also contributing to departure delays on Saturday, and the number of aircraft queued for take-off that ultimately were forced to return to gates, were the rapid snow accumulation, poor visibility, and snow drifting onto active runways. These conditions forced de-iced aircraft to wait for additional plowing. These aircraft then required further de-icing.

- **The decision to restart NWA operations on Sunday.** The plan formulated on Saturday night to commence DTW operations at noon on Sunday was based on a central assumption that proved to be incorrect: that NWA would have enough gates available to accommodate the limited arrivals scheduled for Sunday. As explained below, the lack of clear and coordinated communications between the

SOC Director and his staff in Minneapolis and NWA management at DTW prevented the SOC Director from realizing that this assumption was incorrect until it was too late to cancel or divert many of Sunday's planned arrivals. (As explained in later sections of our findings, a variety of factors made gates unavailable.)

NWA management at DTW gave the SOC Director repeated assurances Saturday night and early Sunday morning that NWA's DTW facilities would be ready for operations commencing at noon on Sunday. For the reasons listed below, the SOC Director did not question these assurances until he noticed that scheduled noon-hour departures were not leaving their gates. By this time, several flights had already departed for DTW.

- First, the storm total of 10.6 inches of snow, while uncommon for Detroit, did not seem to the SOC Director to be an amount that would present an insurmountable challenge to an airline accustomed to operating in harsh winter weather, especially at its Minneapolis hub and other airports in the northern tier of the United States. He was initially unaware that high winds were causing drifting and wind chills that reached -20 to -30 degrees on Sunday and did not fully appreciate that DTW's infrastructure was not as well equipped as Minneapolis to respond to the aftermath of a large snowstorm.
- Second, in his initial contacts with NWA's DTW Control Center Manager, he was told of problems that seemed surmountable in the time allotted and was given no indication that they were not. He was not given a clear indication of the magnitude of the problem created by the snowed-in aircraft and baggage carts that had been parked in the alleys the night before.
- Third, he was aware that DTW's taxiways and runways were plowed and therefore assumed that the rest of the airport was sufficiently clear of snow to allow unimpeded operations. He did not know until 1:00 p.m. that some of the alleys were unplowed and blocked by parked aircraft and baggage carts.
- Fourth, while the SOC Director anticipated a shortage of flight crews due to flight cancellations on Saturday, he did not anticipate that the storm's aftermath would prevent crews already in the Detroit area from getting to the airport, thus creating a more serious crew shortage. Without sufficient crews, NWA could not launch enough aircraft from DTW to free sufficient gates to deplane passengers on incoming flights in a timely manner.
- Finally, while addressing the DTW situation, he and his staff were at the same time handling serious weather-related problems at other airports,

some of which seemed at least as difficult as DTW's: NWA had a total of about 50,000 passengers stranded at airports around the country and the storm was disrupting all of the airline's East Coast operations at the same time that the DTW situation was unfolding.

- **The decisions to delay and then stop NWA arrivals on Sunday.** Even when the SOC Director realized that DTW would not be able to accept flights at noon, he believed that the airport would be able to do so by mid-afternoon and thus he simply delayed the launching of other flights to time their DTW arrival for when he estimated that gates would be available. He subsequently ordered additional delays, but in the meantime, some flights had departed for DTW. Moreover, flights already in the air were allowed to continue to Detroit, as on one occasion were flights that had taxied away from gates but had not yet taken off for DTW. The SOC Director concedes that the latter decision was a mistake. When the SOC Director at 3:40 p.m. requested a national ground stop of flights scheduled to depart for DTW, 36 flights were already on the ground at DTW. Of the 36, 29 were still waiting on taxiways and ramps for gates, and the last of those to deplane its passengers did not do so until approximately 11:30 p.m., after a wait of 8 hours 38 minutes.

The arrival on Sunday of more aircraft than DTW had available gates, stranding passengers in aircraft for hours, resulted in large part from inadequate communication between the SOC Director and his staff in Minneapolis and NWA management at DTW. The information that was passed on to the SOC Director on Sunday morning was at times unclear and incomplete and was transmitted in an ad hoc manner. As such, the SOC Director and his staff had little basis for questioning their assumptions about the progress of Sunday's preparations until too many aircraft were already committed to arrive in Detroit. Even after noon on Sunday, when the SOC Director and his staff began to get a better understanding of the extent of the problems at DTW, they still were not given a clear assessment of the situation at the airport and, as a result, first implemented rolling arrival delays rather than immediately requesting a national ground stop of NWA flights into DTW. Additionally, as a draft NWA internal review of the airline's response to the storm concluded, "[t]he problems associated with a storm of this intensity should not have been a surprise." To a degree, then, the SOC Director and his staff did not ask the right questions under the circumstances.

Although NWA has no operating standard indicating what is a permissible ground delay, the SOC Directors and their staff stated that they never would have permitted aircraft to leave for DTW had they known that those aircraft might experience major ground delays. They would likely have had that knowledge, and avoided or mitigated any backlog of aircraft waiting for gates, had they and key DTW personnel reviewed major storm response issues in regularly scheduled conference calls on Saturday and Sunday.

NWA's Assessment of its Preparations for Sunday's Operations

- A number of the NWA managers interviewed stated that they always seemed a half hour away from reaching their goals of clearing snow, moving aircraft, and preparing gates. "We half-houred ourselves to death," stated one NWA manager. Another common observation was that the hours passed by like minutes that Sunday. These perceptions suggest that while NWA employees at DTW worked very hard in attempting to prepare the airport for Sunday operations, they were so preoccupied with "putting out fires" that they failed to recognize and communicate the overall severity and implications of the problems they faced throughout the day. Indicative of this problem was the fact that NWA management at DTW did not realize until noon, when Sunday's first flights were scheduled to depart, freeing gates for arriving aircraft, that they were severely short of crews to operate those flights.

NWA management at DTW was not alone in experiencing this problem. The Airport Director, for example, was personally engaged in, among other things, assisting passengers stranded in the terminal buildings. As a result, he stated that he was unaware of the fact that dozens of aircraft full of passengers were stranded on his airport's taxiways until, at approximately 4:00 p.m., he was informed of this situation by an individual in the terminal who had come to pick up one of these passengers.

- One NWA executive observed that NWA management at DTW, confronted with a combination of problems that it had never before encountered, did not listen correctly to its staff, did not close loops, and did not manage its resources effectively. Had NWA had a snow emergency plan for DTW that designated a person to oversee and assess the airline's response to this severe snowstorm -- that is, to see the forest and not just the trees -- and communicate its progress to the SOC Director, then the SOC Director would have received a more accurate assessment of that progress and would likely have implemented a more conservative Sunday arrival schedule.

Snow Removal

- **NWA's view.** According to NWA, there were serious shortcomings in WCDA's snow removal efforts. NWA noted that on Saturday afternoon and early evening, although DTW never officially closed and at least one runway was at all times open, WCDA's plows could not always keep up with the rate of snowfall and drifting snow on runways, on taxiways, on ramps, and on the de-icing pad being used by NWA. This caused departure delays that were then exacerbated by recurrent aircraft de-icing. On Sunday, NWA complained that WCDA did not plow NWA's alleys as required by WCDA's snow plan, did not notify NWA of the movement of its snowplow crews as required by WCDA's snow plan, left snow piles and drifts at the throats of alleys, created high ridges of plowed snow along the sides of taxiways, and did not plow a de-icing pad and areas where

empty aircraft could have been parked, all of which impeded or prevented the movement of aircraft, particularly the removal of empty aircraft from gates that were needed to deplane passengers from arriving flights.

NWA concedes that it lacked sufficient equipment to adequately plow the areas it was responsible for -- from the terminals out to the end of the aircraft's tail, including the area around the tires of its jet bridges. This impeded the use of the jet bridges and rendered at least one of them inoperable. This situation was exacerbated by the fact that this was the first major snowstorm experienced by DTW since NWA had switched from gate to remote de-icing of aircraft. De-icing fluid applied to aircraft at the gate would run off and help keep gate areas free of snow and ice. NWA had not anticipated the impact of the absence of de-icing fluid run-off at the gate areas.

NWA agreed that its decision to park aircraft and baggage carts in alleys on Saturday night prevented it from using gates in those areas on Sunday after that equipment became snowed in. (See Appendix D.) NWA noted, however, that because of weather conditions, the aircraft could not have been towed elsewhere on Saturday night and that there was no other space for the baggage carts given that virtually all NWA gates were occupied.

- **WCDA's view.** According to WCDA, it essentially fulfilled its snow removal responsibilities. WCDA notes that all of its snowplow drivers were working that weekend with the exception of one driver whose wife was having a baby. WCDA insists that on Saturday, at least one runway was always safe to use, and WCDA is proud of the fact that it did not need to close the airport. WCDA notes that the de-icing pad might not have been plowed as soon or as often as needed by NWA, but WCDA plowed the pad in the order of priority that it was listed in the airport snow plan and did the best it could to keep up with the heavy rate of snowfall.

WCDA concedes that on Sunday it did not notify NWA of the movement of its snowplow crews. Moreover, it is undisputed that icy conditions in plowed alleys and taxiways on Sunday delayed aircraft movements and caused skidding, and that some larger aircraft required wing walkers to negotiate taxiways lined with snow banks. WCDA disagrees with many of NWA's other complaints, however. Specifically, WCDA noted that it was impossible to plow NWA's alleys per the snow plan schedule because they were clogged with aircraft and baggage carts that had been parked there the night before and had become snowed in. As to snow piles, drifts, and ridges, WCDA concedes that some might have existed, but insists that it did the best it could to eliminate those obstacles and that NWA's complaints are exaggerated. The Airport Director noted that he personally counted 37 out of the total of 60 NWA gates that were clear of snow and from which parked aircraft could have been moved by NWA. WCDA also insists that the de-icing pad and prospective aircraft parking areas were plowed.

WCDA noted that after the snowstorm, it asked all the airlines to critique its snow plan in light of its performance during the storm. NWA suggested a few changes that WCDA made and are discussed below. WCDA considers these changes minor. The other airlines suggested no changes to the plan and generally thought that WCDA had done a good job removing snow during and after the storm.

- The review team cannot resolve the differences between NWA's and WCDA's recollections of snow removal efforts. Under either version of events, however, it is clear that communications between these two organizations regarding snow removal priorities were haphazard. Indeed, their lingering differences over this issue are indicative of these communications problems. Both NWA and WCDA could have improved snow removal efforts through formal communications channels set up as part of a snow emergency plan and through a clearer understanding of their respective snow removal obligations.

Aircraft Positioning

- This issue is important because the positioning of aircraft at various times during the weekend of the snowstorm had an impact on NWA's ability to use its gates for the aircraft that arrived on Sunday and its ability to cater stranded aircraft or deplane passengers using mobile or integrated aircraft stairs.
- As noted above, NWA's decision to park aircraft and baggage carts in alleys on Saturday night prevented the airline from using gates in those areas on Sunday after that equipment had become snowed in.
- NWA and WCDA do not agree on where the aircraft that experienced lengthy Sunday tarmac delays were parked. NWA stated that most of their aircraft were parked on the relatively remote Papa, Tango, and Whiskey taxiways. (See Appendix C.) According to NWA, access to aircraft at these locations for remote deplaning or catering was virtually impossible because the taxiways are relatively narrow to begin with and snow banks further impeded access. WCDA stated that NWA aircraft were parked on the relatively wide Uniform taxiway and on Zulu taxiway, which provides access to hangars and various DTW ground service support facilities. (See Appendix C.) WCDA stated that these areas were plowed. NWA, on the other hand, stated that it was actually denied use of Zulu for all but two of its occupied aircraft because Zulu had not been completely plowed and because the presence on Zulu of two Air Canada diversions from Toronto prevented use of that taxiway as a parking area for empty aircraft. WCDA stated that it was unaware of any request for aircraft parking space that was denied.
- The review team cannot resolve the differences between NWA's and WCDA's recollections of where aircraft were parked on the Sunday after the storm and on other aircraft positioning issues. However, NWA's and WCDA's persistent differences over this issue are symptomatic of the communications problem

between these two organizations during the snowstorm and its aftermath. Had a coordinated plan existed prior to the storm that identified areas available for the "overflow" parking of empty aircraft, and had WCDA clearly understood NWA's aircraft positioning needs on Sunday, then sufficient gates could have been made available to accommodate much of Sunday's incoming aircraft. In addition, NWA might have been able to initiate remote deplaning and catering operations as needed, although the other factors discussed below would have influenced that decision.

Sunday Ground and Flight Crew Staffing Levels

- Although it had stopped snowing at approximately 6:00 a.m. Sunday, partially plowed and unplowed streets and highways, bitter cold temperatures, high winds, and drifting snow made travel to the airport difficult. Heavy traffic and partially unplowed roads and parking lots hampered entry to the airport itself.
- NWA's overall Sunday staffing at DTW was less than 50% in the morning, increasing to about 66% through the afternoon. NWA's Maintenance Department, the group assigned NWA's snow removal responsibilities, was almost fully staffed on Sunday due to the fact that the midnight maintenance shift was held over Sunday morning and that many maintenance employees drive four-wheel drive vehicles and thus did not have as difficult a time driving to work on Sunday. NWA management in Detroit indicated that it had sufficient ground personnel to handle the number of departures or movements of empty aircraft from gates that would have been necessary to allow the timely deplaning of passengers on arriving aircraft.
- WCDA had 98% staffing on Sunday. As noted above, all but one of the snow plow drivers, who are contract employees, reported to work. Many WCDA employees reported to work even though it was their day off. Lack of staff did not hinder WCDA's Sunday operations. WCDA booked hotel space for employees so they would not need to make difficult trips to and from the airport.
- Most other airlines serving DTW had close to 100% staffing once they restarted their operations on Sunday. Although one airline experienced departure delays of up to two hours, lack of staff generally did not hinder most airlines' Sunday operations. Most of these airlines booked hotel space for employees so they would not need to make difficult trips to and from the airport, but none of these airlines indicated that the availability of these hotel rooms was critical to maintaining adequate staffing levels that weekend.
- Approximately 70% of the NWA flight crew members who are based in Detroit do not live there and therefore must commute to Detroit from other cities, usually on NWA flights. Some of these crews were unable to get to Detroit as planned on Saturday. Others were stranded on Sunday arrivals that sat for hours on taxiways waiting for gates to clear. In one case, a flight carrying a number of flight crews

from Minneapolis was assigned a gate only after a member of one of those crews used his cell phone to call a dispatcher in Minneapolis and advise him of the situation. Because of poor road conditions, many hotels in the area were not running their airport shuttles, thus stranding crews staying at those hotels. Crews that were able to make it to the airport were not necessarily qualified on the types of aircraft that were scheduled to depart.

- NWA's various automated crew communication and scheduling systems were overloaded and in many cases rendered ineffective. Crew Schedulers and Crew Coordinators were so overwhelmed by the flight crew call volume that they were unable to pass crew availability information on to Operations Planners. Many crew members could not get through to Coordinators and Schedulers to report their status, and they eventually stopped trying. Operations Planners were unable to work with Crew Coordinators because they were taking calls directly from crews. Scheduling and coordination problems created by these circumstances exacerbated crew shortages.
- As noted above, although the SOC Director anticipated a shortage of flight crews due to flight cancellations on Saturday, he did not anticipate that the storm's aftermath would prevent crews already in the Detroit area, in hotels or on incoming aircraft, from getting to the airport terminal. NWA management at DTW also did not anticipate this additional shortage. One NWA manager interviewed considered the flight crew shortage the airline's "biggest downfall" on Sunday, a "piece that we missed." Without sufficient crews, NWA stated that it could not launch enough aircraft from DTW to free sufficient gates to deplane passengers on incoming flights in a timely manner, and that it could not taxi or tow unloaded aircraft away from the gates because of inadequate space to park the aircraft.

NWA's Treatment of Passengers Stranded on Its Aircraft

- **The efforts of NWA's employees.** Even some of the angriest complaint letters received by DOT from passengers who experienced hours-long ground delays complimented the fine performance of the flight crews on those aircraft. While flight crews could not reduce ground delay time, they prevented a very bad situation from getting worse. Additionally, NWA management at DTW stressed to the review team that the NWA employees who worked at DTW during the snowstorm and its aftermath worked extremely hard to make a very difficult situation as bearable as possible for passengers on aircraft and in the terminal. They noted that they had received many positive comments and letters from passengers about NWA's performance that weekend.

It should be noted, however, that many passengers interviewed by DOT stated that when they finally deplaned and sought out their baggage on Sunday night, there were few, if any, NWA personnel to be found in a terminal environment that was characterized as "a zoo," lacking any organization whatsoever. Some

passengers who were assisted by NWA personnel thought they were doing the best they could under the circumstances, while others stated that NWA personnel were "clueless" and "couldn't have cared less." The latter type of observation was also made by passengers who were returned to the terminal on Saturday night.

- **NWA's customer service orientation.** Many NWA managers interviewed by the review team unequivocally agreed that ground delays of the length experienced on the first weekend of January are unacceptable from a customer service standpoint. In addition, as noted above, many NWA employees received high praise from their customers and management for their exceptional efforts in assisting travelers during and after the snowstorm. It should also be noted, however, that some NWA executives interviewed minimized the impact of the long ground delays. One NWA executive suggested that experiencing these delays, which resulted in passengers spending up to 8_ hours in a confined space at times without food, lavatories, and, in some cases, water, was no worse than being diverted to another airport and being forced to sleep in a terminal. Another observed that many NWA customers pay considerable sums to sit in their aircraft for as many as 13 hours on non-stop flights from the United States to Asia, implying that passengers' experiences at DTW were somehow comparable. Some also stated that the remedial measures that NWA has implemented or is contemplating are to correct "errors on the margin" and would not necessarily prevent a recurrence of lengthy passenger strandings.
- **Use of other airlines' gates.** One airline, Continental, provided an unused gate for NWA's use at NWA's request. NWA deplaned passengers from three flights at this gate. Other airlines indicated that NWA either did not ask them for use of their gates or that when NWA did ask, their gates were not available because they were occupied or about to be occupied by their own aircraft. All of the airlines that NWA did not ask for gates stated that they would have made unused gates available had NWA asked. Only one airline, US Airways, declined to offer an available gate when asked for fear that NWA would not be able to move its aircraft from the gate once passengers had deplaned. The other airlines were not aware of NWA's stranded passenger situation until NWA contacted them about the use of their gates.

NWA conceded that it did not clearly communicate the urgency of its gate requests and the temporary nature of its use of the gates. NWA stressed, however, that cost of gate rental was not a consideration in requesting other airlines' gates, given the minimal cost for such rental (approximately \$150 per use).

NWA clearly could have done more to secure use of other airlines' gates. As with other aspects of their response to the snowstorm, NWA's efforts in this regard lacked foresight and coordination. While the use of other airlines' gates might not have eliminated Sunday's tarmac delays, it certainly would have mitigated them.

- **Stair deplaning.** NWA considered and rejected twice using the integrated stairs on some of its aircraft to deplane passengers away from the gates into waiting car rental company buses that had been requisitioned by WCDA per WCDA's contract with those companies. It was NWA's ultimate judgment, including that of a veteran NWA de-icing manager, that it was too cold, windy, and icy on Sunday to safely deplane passengers in this manner.

Representatives from every other airline interviewed stated that they would have found a way to safely accomplish remote deplaning to avoid stranding passengers on their aircraft for up to 8_ hours. Moreover, NWA's own irregular operations plan for its Minneapolis hub includes stair deplaning procedures. And at DTW that Sunday, Spirit Airlines did in fact safely deplane passengers using the integrated stairs on one of its DC-9 aircraft, which are similar to the DC-9s flown by NWA. That deplaning occurred in Spirit's hangar, with passengers being taken into waiting rental car company buses and then to the terminal. Spirit indicated that while its hangar offered its passengers some protection from the elements, the passengers were still exposed to the cold. Stranded NWA passengers who were later interviewed almost unanimously indicated that they would have preferred deplaning by remote stairs, and many urged NWA to formulate a plan to do so should similar circumstances arise in the future.

While NWA's hangars were not available for deplaning because they were filled with aircraft, NWA did not consider all of its stair deplaning options. NWA could have worked with WCDA to identify and, if necessary, plow and de-ice a relatively protected area of the airport to deplane passengers, such as an area near a gate or other structure. With respect to its aircraft lacking integrated stairs, NWA understandably rejected the use of relatively unstable maintenance stairs, the only type of mobile stairs they owned, but apparently did not consider borrowing the appropriate mobile passenger stairs from another airline. It is possible that even if NWA had considered these options, it still would have rejected stair deplaning. However, these options should have been considered, at least as a last resort for deplaning passengers that had been subject to the longest ground delays.

- **Remote catering and lavatory servicing.** Remote catering of aircraft on Sunday ran the risk of damaging aircraft given that the drivers for catering contractors are not necessarily trained to service aircraft parked on potentially icy areas of the airport. However, as was the case with remote deplaning, NWA could have worked with WCDA to plow and de-ice areas near the aircraft to allow safe remote catering. (If an area were safe enough to perform catering, however, then stair deplaning would likely also have been possible and might have been the preferred option.) NWA was able to service lavatories on three aircraft in an area near US Airways' gates. It had to cease this operation when US Airways indicated that it was blocking access of its aircraft to its gates. NWA's ability to

perform limited remote lavatory servicing suggests that with proper planning, a greater number of such operations could have been performed if necessary.

- **Baggage problems.** An examination of the problems NWA had in delivering checked baggage to its passengers who arrived at DTW on Sunday was beyond the scope of this report. It should be noted, however, that almost every passenger interviewed had major complaints about NWA's handling of their baggage. Most of these passengers did not see their baggage for days, and some did not for weeks. Most found it difficult or impossible to obtain information about their baggage from NWA, and many who did receive information found that it was incorrect.

PART III: REMEDIAL MEASURES

NWA and WCDA have taken or are considering taking several remedial actions to try to prevent a repetition of the lengthy ground delays of January 2 and 3, 1999.

- **Preparation of an NWA Irregular Operations Plan for DTW.** While NWA has an Irregular Operations Plan covering operations during a snowstorm for its Minneapolis hub, it has no such plan for its largest hub, Detroit. NWA now plans to draft an Irregular Operations Plan for snowstorm operations at DTW. Many of the specific remedial measures discussed below will be part of that plan.
- **Revision of SOC Winter Response Manual.** NWA will bolster certain procedures in the SOC's Winter Response Manual in order to address communication problems with DTW during snowstorms. These revisions will include mandatory periodic conference calls involving key personnel in Minneapolis and DTW before, during, and after snowstorms. During these calls, specific questions in checklist form relating to major storm-related issues such as gate availability, snow removal, and staffing will be addressed.
- **WCDA Presence in NWA Tower.** WCDA will have an operations specialist present in the NWA ramp tower during snow removal operations in order to better coordinate its efforts with NWA's needs. This measure has already been implemented and, according to NWA and WCDA, worked very well during the snowstorm of March 5 and 6, 1999, when eight inches of snow fell at DTW. The improved results in handling that storm are indicative of the effectiveness of this and other remedial actions already taken.
- **Snow Removal Improvements – NWA.** NWA will equip additional baggage tugs and jet bridges with plows to improve its snow removal efforts around gates. NWA is considering having WCDA assume its snow removal responsibilities.
- **Snow Removal Improvements – WCDA.** At NWA's suggestion, WCDA has added an extra crew to plow snow in the alleys and ramps and has made plowing the remote de-icing pads a higher priority. It has also committed to ensuring that NWA receives notice of its alley plowing schedule as required by the airport's snow plan and to doing a better job of clearing snow piles. In addition, WCDA will have one of its snow removal contractors provide more snow-removal equipment for removal of snow from certain aircraft parking areas. Finally, at NWA's suggestion, WCDA reviewed its snow plan with representatives of Minneapolis/St. Paul's Metropolitan Airports Commission and will consider their suggested improvements.
- **Arrival Delay Guidelines.** NWA is considering drafting guidelines for defining what are unacceptable ground delays upon arrival in order to enhance employee awareness of arrival delays and to place extra emphasis on getting delayed flights to a gate. One NWA manager suggested that a 30-minute arrival delay would

send up a red flag and that a one-hour arrival delay would trigger additional emphasis.

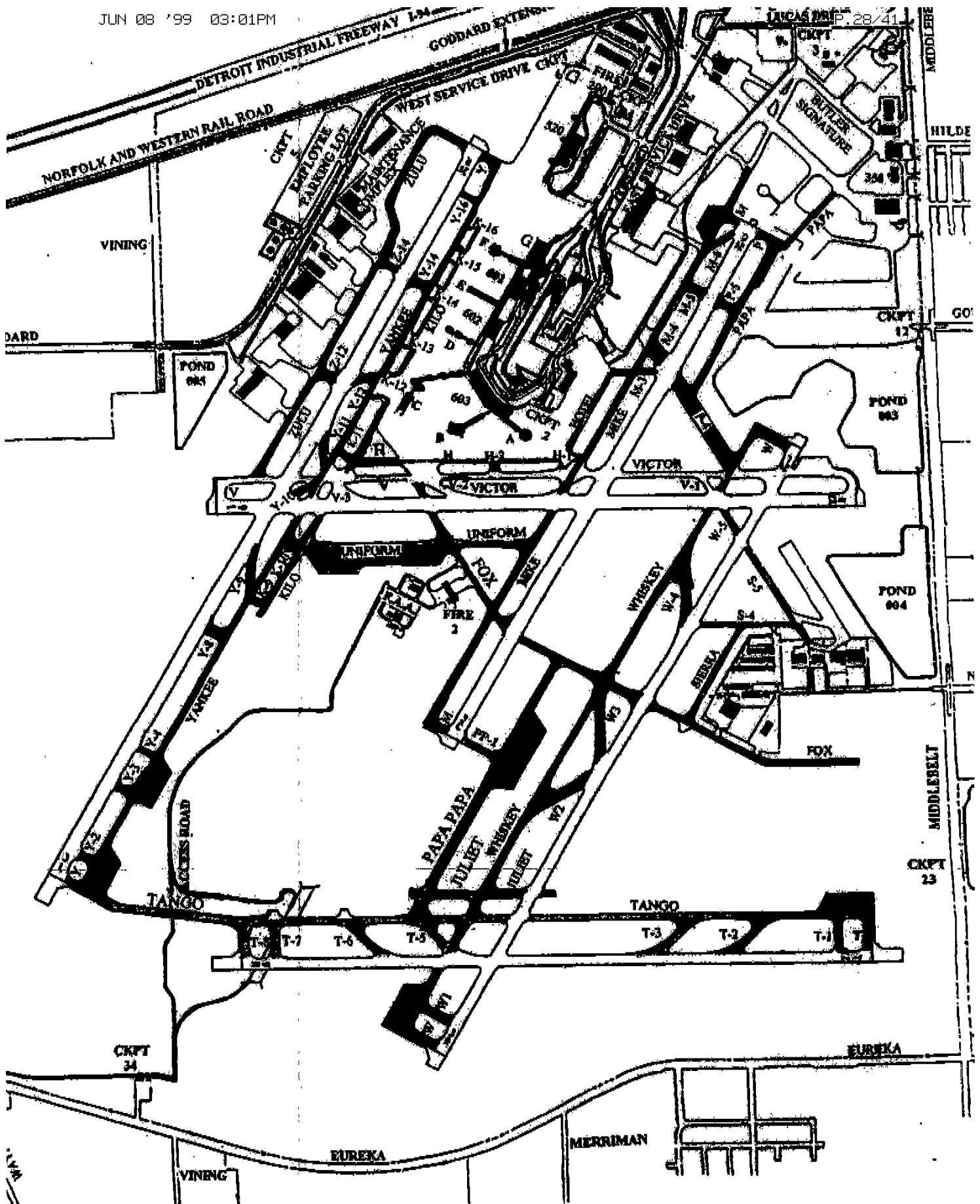
- **Aircraft Positioning.** NWA will work with WCDA to designate possible aircraft parking areas in the event of a snowstorm.
- **NWA Staffing.** NWA has implemented a number of improvements in its communications systems in order to support its crew coordination and scheduling functions. These include the addition of more telephone lines, the implementation of an enhanced automated weather alert system for crews, increased automated information retrieval to reduce the time spent by coordinators and schedulers personally handling telephone inquiries, and enhanced call screening and queuing capabilities.
- **Stair Deplaning.** NWA is considering procedures that would allow stair deplaning in certain circumstances. Procedures would include the designation and preparation, in conjunction with WCDA, of an area or areas where stair deplaning could be safely performed, the purchase of appropriate passenger stair trucks, and the formulation of a ground delay standard that would trigger the plan's implementation.
- **Management Awareness.** According to NWA, management is now more conscious of the need to bring resources to bear in irregular situations such as snowstorms and realizes that NWA's "keep things moving" mission focus at times must be reevaluated.

The FAA's Certificate Management Office for NWA will coordinate closely with NWA on these actions, and will maintain a "heightened situational awareness" when a major snowstorm hits Detroit.

Finally, it should be noted that NWA is well aware that its customers were not satisfied with its service during the storm. NWA has, accordingly, attempted to make amends with those customers by sending a letter of apology and a voucher for a free round trip ticket to each passenger who experienced a ground delay of at least 2 hours while in Detroit on January 2-4. NWA stated that it had already issued approximately 8,500 of these vouchers.

APPENDIX A

MAP OF WAYNE COUNTY DETROIT METROPOLITAN AIRPORT



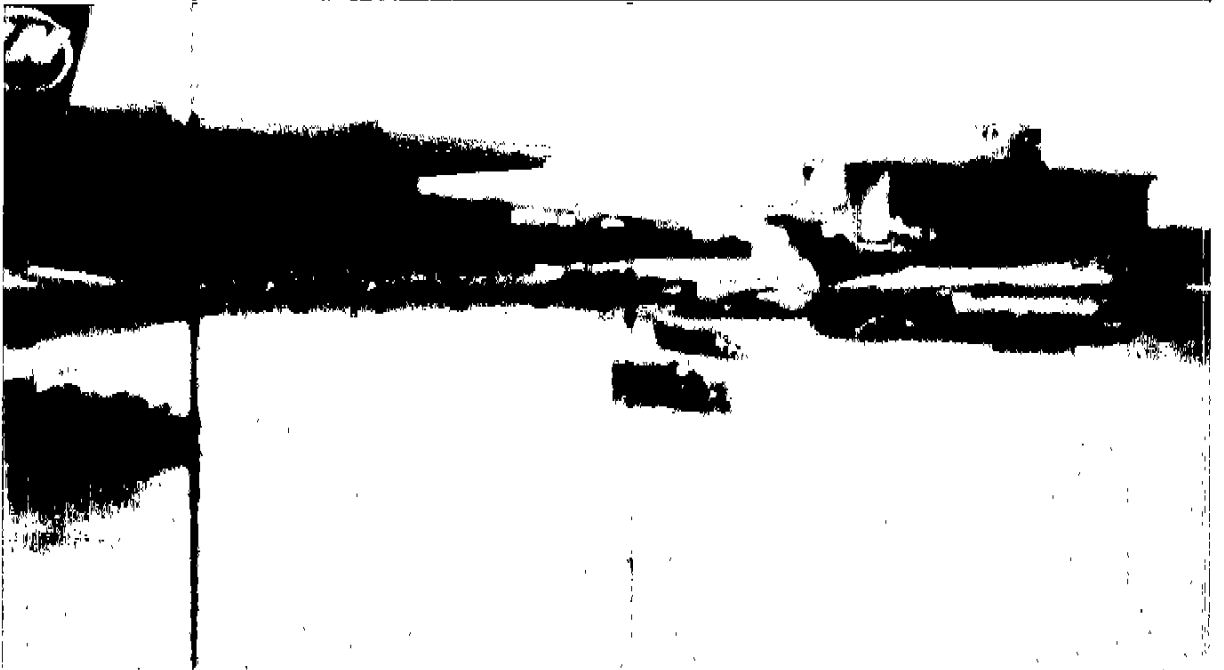
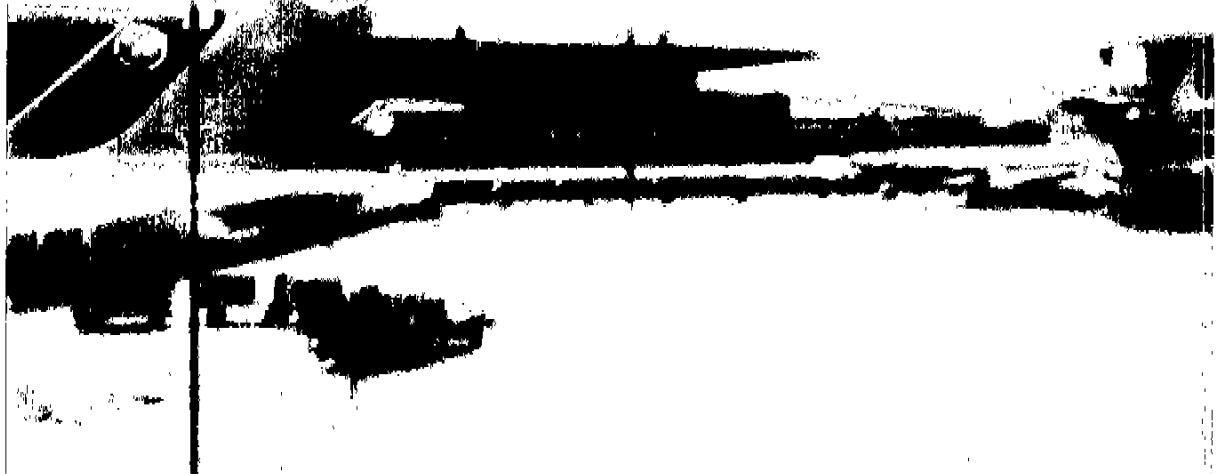
APPENDIX B

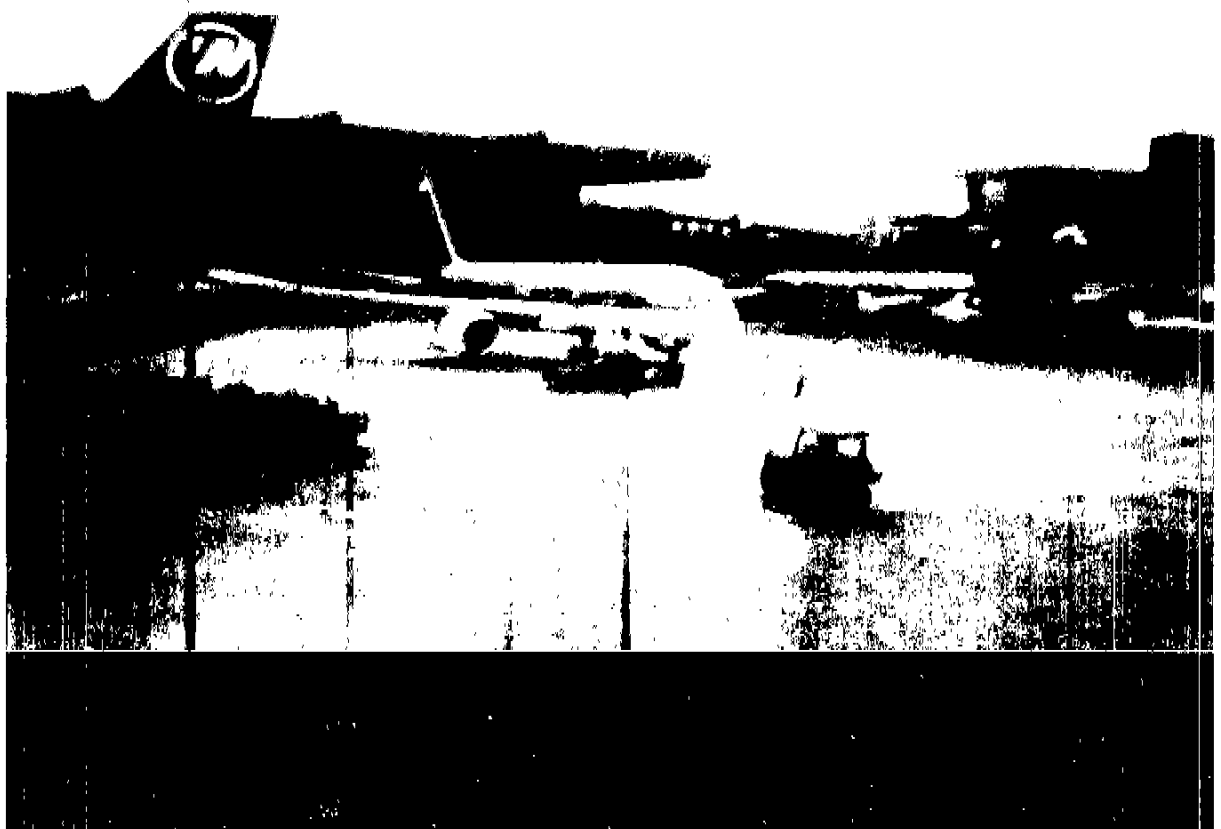
**AERIAL PHOTOGRAPH OF WAYNE COUNTY DETROIT METROPOLITAN
AIRPORT TERMINAL AREA**

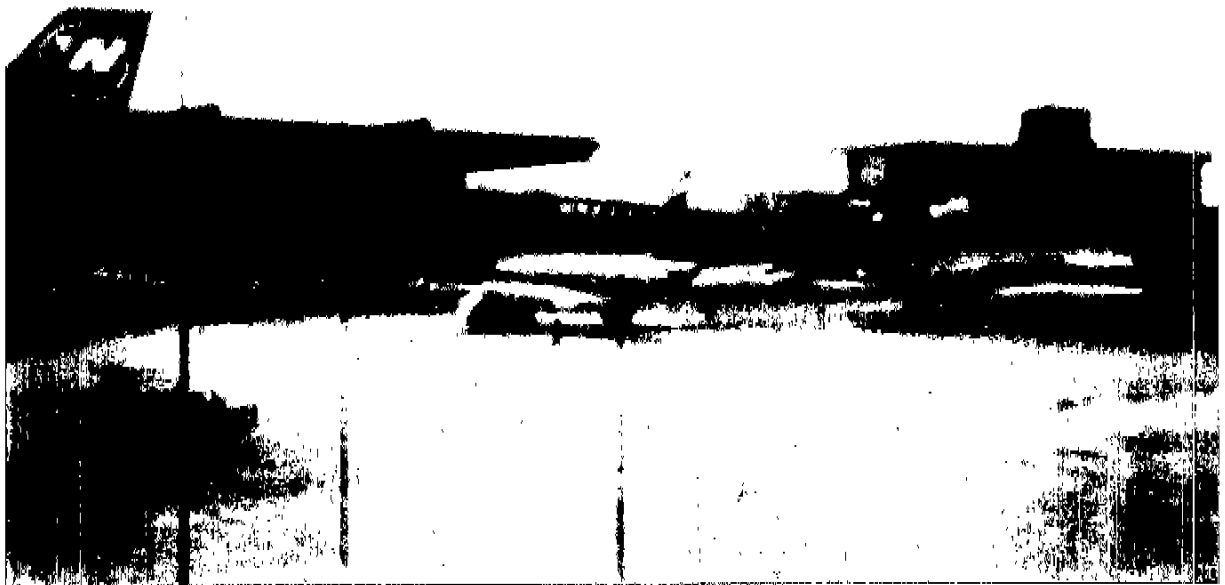


APPENDIX C

**PHOTOGRAPHS OF ALLEY BETWEEN NWA TERMINAL PIERS E & F
TAKEN BY THE REVIEW TEAM ON APRIL 14, 1999**







APPENDIX D

**FRAMES FROM SECURITY CAMERA FOOTAGE SHOWING THE ALLEYS
BETWEEN NWA PIERS C & D AND D & E ON SUNDAY, JANUARY 3**

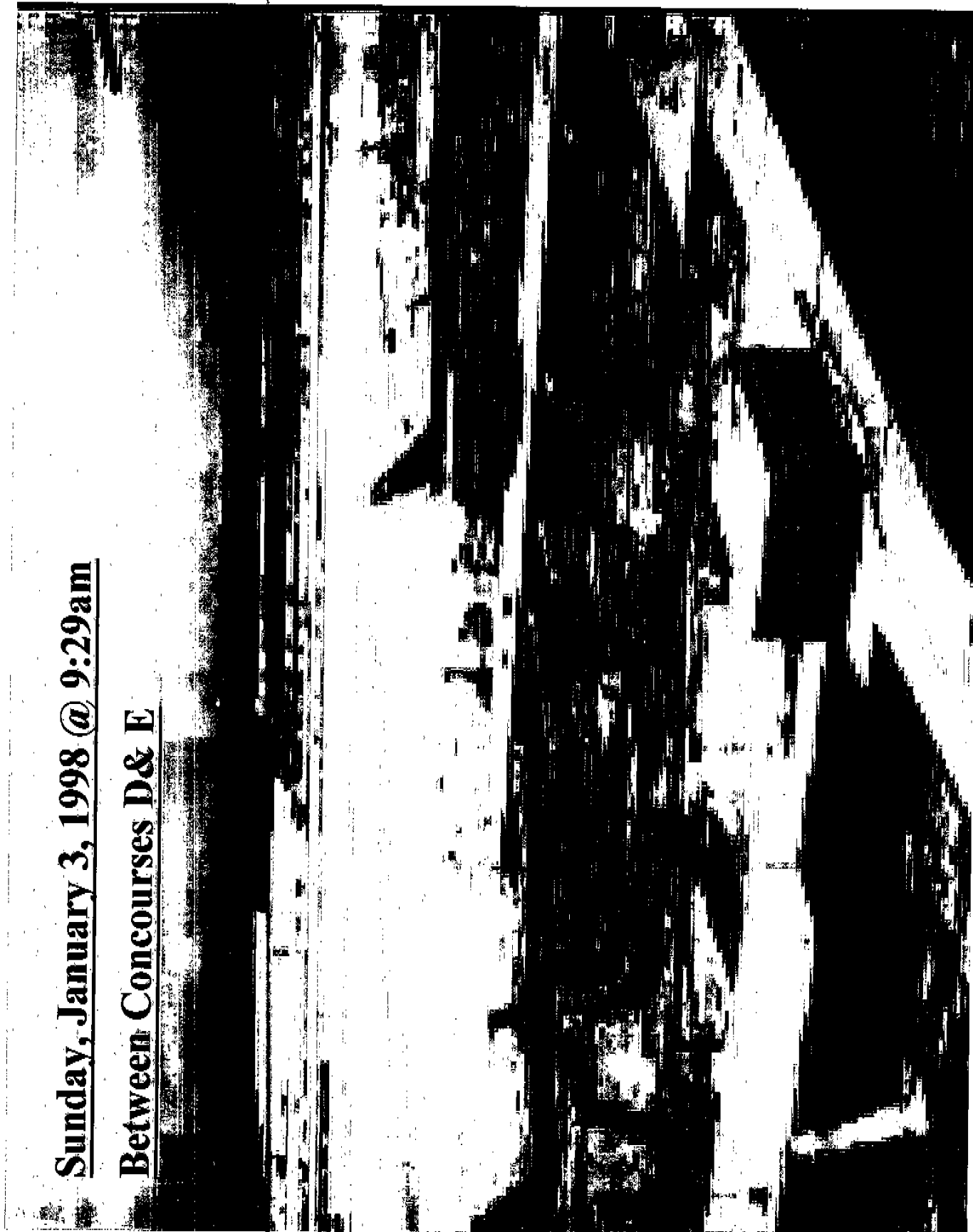
Sunday, January 3, @ 12:30pm

Between Concourses C & D



Sunday, January 3, 1998 @ 9:29am

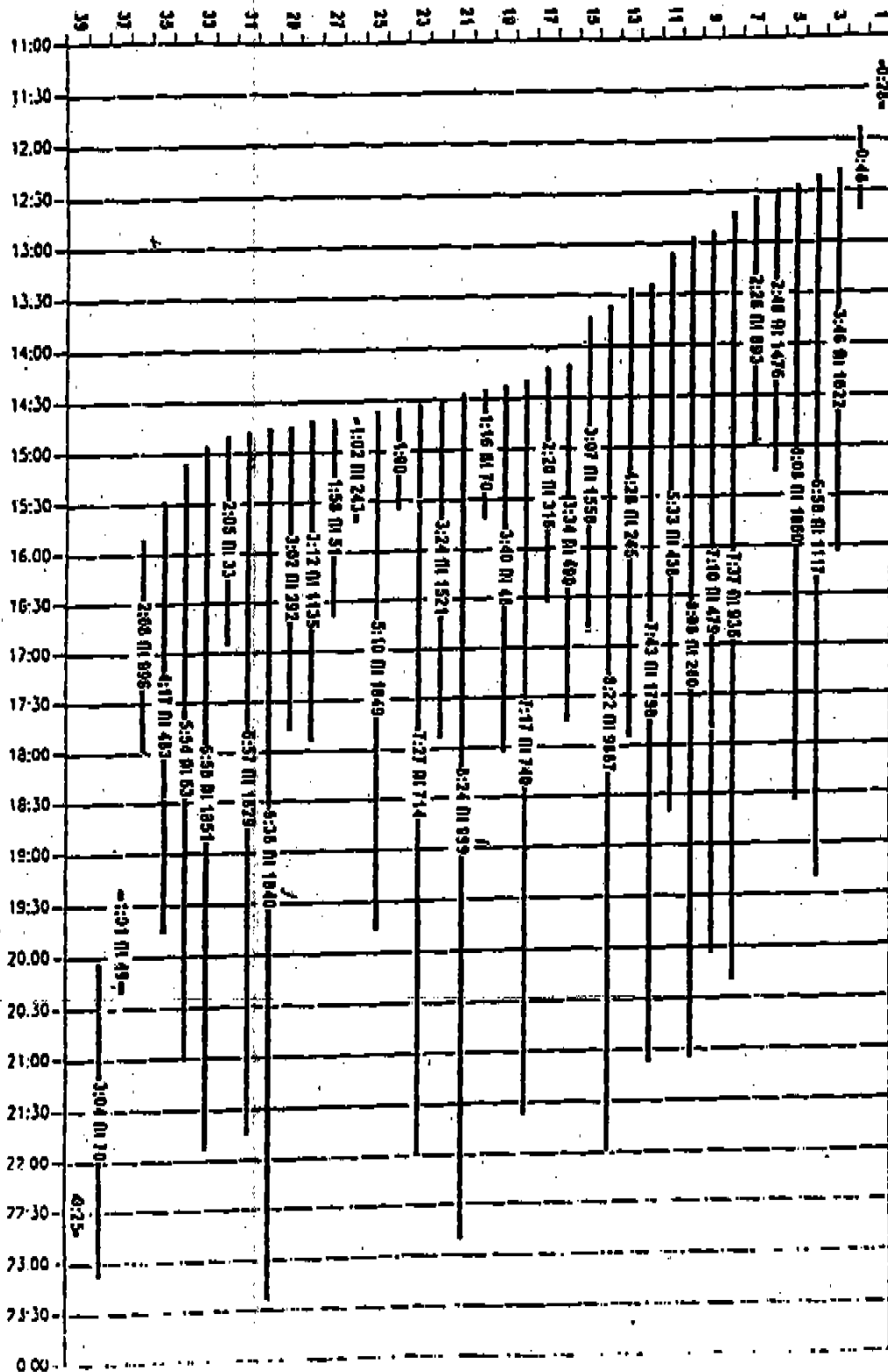
Between Concourses D& E



APPENDIX E

**NWA GRAPH DEPICTING NWA ARRIVAL GROUND DELAYS ON SUNDAY,
JANUARY 3**

Daily Arrival Order



DTW 1/3/99 Arrivals and Taxi in by Time of Day

APPENDIX F

INDIVIDUALS INTERVIEWED

<u>Organization</u>	<u>Name</u>
American Airlines	Jim Spriggs
Continental Airlines	J. J. Garner
Delta Air Lines	Harry Hendrix
NWA (Detroit)	Bob Ball Harry Butler Joseph Fillar Barry Fitzgerald Brian Jaeger Peter Kenney Andrea Newman Terry Parker Raymond Vecchi Dan Vella
NWA (Minneapolis)	Lorne Cass Steve Deters Gary Erickson Ron Fritz Jeff Hart Deb Johnson Peter Kenney John Kern Jeff McClelland Don McIntire Bob Meeks Wallace Nicklaus Scott Ramsay Tim Rainey Lloyd Samuelson Bill Wade Doug Wood Paul Wroble
Southwest Airlines	Craig Cotter

Spirit Airlines

Michael Cox

TWA

Cindy Carter
Paul Wipf

United Airlines

Dave Roberts

US Airways

Bridget Donohue

WCDA

Michael Conway
Nozmi Elder
David Katz
Daniel Kerber
David Kolasa
Brian Lassaline
Cornell Mays
Vincent Petitpren
Charles Sherrill